CLAIMS

What is claimed is:

1.   A method for interconnecting SS7 signaling points (SPs), the method comprising:

5   (a)   connecting a first interface of an edge device to a plurality of signaling points (SPs) using a plurality of fixed-bandwidth SS7 signaling links;

           (b)   connecting a second interface of the edge device to an IP-capable node using a variable-bandwidth signaling link; and

10   (c)   multiplexing messages received from the SPs received over the fixed-bandwidth SS7 signaling links and transmitting the multiplexed messages to the IP-capable node over the variable-bandwidth signaling link.

15 2.   The method of claim 1 wherein multiplexing messages received from the SPs includes encapsulating the messages in IP datagrams and forwarding the IP datagrams over the variable-bandwidth signaling link.

20 3.   The method of claim 2 wherein encapsulating the messages in IP datagrams includes encapsulating the messages in transport adapter layer interface packets and encapsulating the transport adapter layer interface packets in transmission control protocol (TCP) segments.

4.   The method of claim 3 wherein encapsulating the messages in transport adapter layer interface packets includes adding an application-level sequence number to each transport adapter layer interface packet.

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5.   The method of claim 1 wherein multiplexing messages received from the SPs includes performing MTP routing for the messages to direct all of the messages to the variable-bandwidth signaling link.

10 6.   The method of claim 1 wherein multiplexing messages received from the SPs includes performing MTP routing for the messages to determine whether the messages are directed to locally-connected nodes and in response to determining that the messages are not directed to locally-directed nodes, routing the messages over the

15   variable-bandwidth signaling link.

7.   The method of claim 6 comprising, in response to determining the messages are directed to locally-connected nodes, routing the messages to the locally-connected nodes over one of the fixed-

20   bandwidth SS7 signaling links.

8.   The method of claim 6 wherein performing MTP routing on the messages includes extracting destination point code (DPC) values from the messages and comparing the DPC values to point code

25   values stored in a routing table.

9. The method of claim 1 wherein the IP-capable node is an SS7/IP gateway.

10. The method of claim 1 wherein the plurality of SPs are service switching points (SSPs).

11. A method for interconnecting SS7 signaling points (SPs) in a mesh network, the method comprising:

(a) connecting a first interface of a first edge device to first and second SPs in a mesh network using first and second fixed-bandwidth SS7 signaling links;

(b) connecting a first interface of a second edge device to third and fourth SPs in the mesh network using third and fourth fixed-bandwidth SS7 signaling links; and

(c) connecting a second interface of the first edge device to a second interface of the second edge device using a variable-bandwidth signaling link.

12. The method of claim 11 wherein connecting a second interface of the first edge device to a second interface of the second edge device includes establishing a TCP/IP connection between the first and second edge devices.

13. The method of claim 11 wherein connecting the first interface of a first edge device to first and second SPs includes connecting the first

interface of the first edge device to the first and second SPs using SS7 access links.
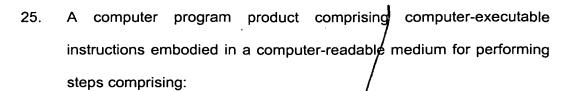
14. The method of claim 11 wherein connecting a first interface of a second edge device to third and fourth SPs includes connecting the first interface of the second interface device to the third and fourth SPs using SS7 access links.

15. An edge device comprising:

(a) a first interface for receiving SS7 message signal unit (MSUs) over fixed-bandwidth SS7 signaling links;

(b) a second interface for multiplexing the SS7 MSUs received by the first interface and transmitting the SS7 MSUs over a variable-bandwidth signaling link; and

(c) a message transfer part (MTP) routing function for determining whether the SS7 MSUs received by the first interface are directed to a locally-connected SS7 signaling point, and, in response to determining that the MSUs are not directed to a locally-connected SS7 signaling point, routing the messages to the second interface to be transmitted over the variable-bandwidth signaling link.

16. The edge device of claim 15 wherein the first interface is a link interface module (LIM) having SS7 layer 2 and layer 3 processes.

17.   The edge device of claim 15 wherein the second interface is a database communications module (DCM) having an SS7 layer 3 process and an SS7/IP converter process for converting SS7 MSUs to TCP/IP format and forwarding the SS7 MSUs over the variable-
5   bandwidth signaling link.

18.   The edge device of claim 17 wherein the DCM is adapted to forward all outgoing SS7 MSUs to a first SS7/IP gateway.

10   19.   The edge device of claim 17 wherein the SS7/IP converter is adapted to encapsulate SS7 messages in transport adapter layer interface packets and to encapsulate the transport adapter layer interface packets in IP datagrams.

15   20.   The edge device of claim 19 wherein the DCM is adapted to add an application-level sequence numbers to the transport adapter layer interface packets.

21.   A method for connecting SS7 signaling points (SPs) to an IP-capable
20   node, the method comprising:
        (a)   locating an edge device proximally to at least one SP;
        (b)   connecting the edge device to the SP using a fixed-bandwidth SS7 link; and

(c)   connecting the edge device to an IP-capable node located remotely from the edge device using a variable-bandwidth TCP/IP signaling link.

5   22.   The method of claim 21 including provisioning the edge device with a simplified message transfer part routing table including routing entries containing linkset addresses corresponding to fixed-bandwidth signaling links for messages directed to locally-connected nodes and a default entry containing a linkset address corresponding to the

10   variable-bandwidth signaling link for messages directed to non-locally-connected nodes.

23.   The method of claim 21 including provisioning the edge device with a simplified message transfer part routing table including a single entry

15   for routing all incoming messages to a linkset address corresponding to variable-bandwidth signaling link.

24.   The method of claim 21 wherein connecting the edge device to an IP-capable node includes the edge device to an SS7/IP gateway.

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25. A computer program product comprising computer-executable instructions embodied in a computer-readable medium for performing steps comprising:

(a) at an edge device, receiving signaling system seven (SS7) signal units over at least one fixed-bandwidth SS7 signaling link;

(b) filtering out predetermined first types of the SS7 signal units received over the fixed-bandwidth SS7 signaling link;

(c) passing predetermined second types of the SS7 signal units received over the fixed-bandwidth SS7 signaling link; and

(d) encapsulating the predetermined second types of SS7 signaling units in Internet protocol (IP) datagrams, and forwarding the forwarding the IP datagrams to an IP-capable node over a variable-bandwidth signaling link.

26. The computer program product of claim 25 wherein filtering out predetermined first types of SS7 signaling units includes filtering out link status signaling units (LSSUs) received over the fixed-bandwidth SS7 signaling link.

27. The computer program product of claim 25 wherein filtering out predetermined first types of SS7 signal units includes filtering out fill-in signal units (FISUs) received over the fixed bandwidth SS7 signaling link.

28.   The computer program product of claim 25 wherein filtering out predetermined first types of SS7 signal units includes filtering out fill-in signal units (FISUs) and link status signal units (LSSUs) received over the fixed-bandwidth SS7 signaling link.
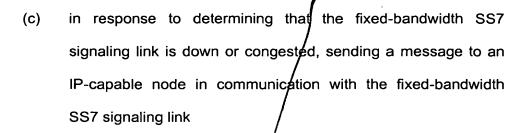
29.   The computer program product of claim 25 wherein passing predetermined second types of SS7 signal units includes passing message signal units (MSUs) received over the fixed-bandwidth SS7 signaling link.

30.   The computer program product of claim 25 wherein receiving SS7 signal units over at least one fixed-bandwidth SS7 signaling link includes receiving the SS7 signal units at an edge device that does not have an SS7 point code.

31.   The computer program product of claim 25 wherein the IP-capable node is an SS7/IP gateway.

32.   A computer program product comprising computer-executable instructions embodied in a computer-readable medium for performing steps comprising:

      (a)   at an edge device, monitoring status of at least one fixed-bandwidth SS7 signaling link connected to the edge device;

      (b)   determining whether the fixed-bandwidth SS7 signaling link is down or congested; and

(c)   in response to determining that the fixed-bandwidth SS7
signaling link is down or congested, sending a message to an
IP-capable node in communication with the fixed-bandwidth
SS7 signaling link

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33.   The computer program product of claim 32 comprising, in response to
determining that the fixed-bandwidth signaling link is congested,
buffering messages received from the IP-capable node destined for
the fixed-bandwidth SS7 signaling link

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34.   The computer program product of claim 32 wherein sending a
message to an IP-capable node includes sending a message to an
SS7/IP gateway over an IP network.

15   35.   The computer product of claim 32 wherein sending a message to an
IP-capable node includes sending a message to a second edge
device over an IP network.

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